United States Department of Agriculture
Agricultural Research Service
Southern Utilization Research Branch

# RICE INDUSTRY RESEARCH CONFERENCE

at

Southern Regional Research Laboratory
New Orleans, Louisiana

November 18, 1955

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# I. PROGRAM

10:00 A. M. CONFERENCE ROOM, SRRL

A. M. Altschul, Presiding

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| Response in Behalf of Rice Industry | Wm. M. Reid, President, Rice Millers Association |
| Review of Rice Research at SRRL and Future Plans for Research | A. M. Altschul, Head Oilseed Section, SURB |
| Report on Working Group of Rice Advisory Committee | F. G. Dollear, Assistant Head Oilseed Section, SURB |
| Plans for Marketing Research on Rice | Marshall Miller Agricultural Marketing Service |

LUNCH

Tour of the Laboratories ---- 1:15 P. M.

2:00 P. M. CONFERENCE ROOM SRRL

Wm. M. Reid, Presiding

Informal Discussion of Research Needs of the Rice Industry

Listing of Research Needs in Order of Priority

Discussion of Plans for an Informal Rice Industry Research Committee.

## II. RICE INDUSTRY RESEARCH CONFERENCE
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### ATTENDANCE LIST

Blair, George B., American Rice Growers, Lake Charles, La.
Boyt, E. V., Devers Canal Co., Box 566, Devers, Texas
Carter, L. C., Arkansas Rice Growers Cooperative Association, Stuttgart, Ark.
DeHarb, Frank E., River Brand Rice Mills, Inc., P. O. Box 2636, Houston, Texas
Doré, Joseph, Supreme Rice Mill, Crowley, La.
Edmundson, E. E., Jr., Edmundson-Duhe Rice Mill, Rayne, La.
Gaines, James P., Rice Millers' Association, New Orleans, La.
Hirth, G. Howard, Campbell Soup Co., Camden, N. J.
Laan, Cyril R., Rickert, Wessanen & Laan, Inc., 210 Girod St., New Orleans, La.
Keneaster, Kenneth, Converted Rice, Inc., Houston, Texas
Leahy, Marshall E., Farmers Rice Growers Cooperative, Suite 1258, Russ Building, San Francisco, California
Montgomery, C. J., Kaplan Rice Mill, Inc., Kaplan, La.
Reid, W. M., The Rice Millers' Association, New Orleans, La.
Smith, W. D., Agricultural Marketing Service, U. S. Department of Agriculture, Room 1401, 333 St. Charles St., New Orleans, La.
Spiller, Dupre, Rice Journal, 806 Perdido St., New Orleans, La.
Tipping, Dolan, The Rice Journal, 806 Perdido St., New Orleans, La.
Villeret, L. A., Comet Rice Mills, 4601 Clinton Drive, Houston, Texas

### Southern Regional Laboratory Personnel

Fisher, C. H.
Altschul, A. M
Cousins, E. R.
Frampton, V. L.
Goheen, G. E.
Hogan, J. T.
Hopper, T. H.
Kime, J. A.
Teunisson, D. J.

## III. SUMMARY OF PRESENTATION BY LABORATORY STAFF

At the morning session and during the tour of laboratories, there was a presentation of current research on rice at the SRRL. This is summarized in the following statements given out during the tours. There is also attached a statement on Marketing Research prepared by Mr. Marshall Miller of the Agricultural Marketing Service.

### Composition and Quality

There exist between different varieties of rice marked differences in culinary quality as revealed by consumers' preferences. What constitutes a "good" rice has different meanings to different populations. Not much information is available regarding the relationship of quality of rice and its physical properties and chemical composition.

Research is being conducted on relating the chemical and physical properties of rice to the part that they play in determining the quality of the grain. A study has been completed in which the quantitative relationship between the time and temperature of cooking, for example, has been related to the loss of solids and solubles to the cooking water as well as the color, texture, consistency and water uptake of the grain. Inasmuch as different people cook rice to different degrees depending upon individual tastes, the data acquired permit correlation of the conditions of cooking time and temperature with rices prepared by standardized procedures.

The principal constituent of milled rice is starch, which composes approximately 90% of the grain. Rice starch in common with other starches, is made up of two substances known as amylose and amylopectin. Glutinous rices, which are low in amylose content (approx. 1 to 2%) are "sticky", whereas "good" rices are high in amylose content (approx. 15-20%). In

addition, certain physical properties, for example the temperature at which starches will swell and become soluble, differ among the rices. The relationship of these fundamental differences to quality should yield useful information applicable to explaining the phenomena of rice quality and perhaps permit the modification of the properties of rice to suit the quality preferences of consumer groups.

Short-term Storage of Freshly Combined, Rough Rice

1. The objectives of this investigation were to determine the cause of short-term souring of freshly-combined, undried, rough rice, and also the conditions under which this souring occurs and can be prevented.

2. Short-term souring in stored, naturally moist, rough rice is apparently due to the anaerobic respiration of the seeds and not to microbial action.

3. Souring occurred in sealed storage and under aeration with a low concentration of oxygen and a high concentration of carbon dioxide.

4. Freshly combined, moist rice can be stored for several days without souring or loss in grade under aeration with normal air or with a gas composed of 12% carbon dioxide, 8% oxygen, and 80% nitrogen, if the rate of flow is at least 0.09 c.f.m./bu.

5. Reduced oxygen supply inhibited the growth of molds usually present beneath the hulls of rice of good quality but this condition combined with a high concentration of carbon dioxide induced loss in seed viability.

6. Maintenance of seed viability is important in preventing internal infection of the brown rice, even though the rice is not to be used for seed purposes.

Rice Oil

Excessive refining losses (about 40%) have made the processing of rice oil unattractive economically. The objective of one phase of our research was to develop practical measures for reducing refining losses and to isolate the unknown minor component in rice oil responsible for the high losses.

Using chromatographic procedures, practically all of the material responsible for the high refining loss was isolated in a fraction amounting

to about 15% by weight of the original oil. As a result of laboratory observations, a promising method of reducing the refining loss of rice oil has been developed involving chemicals as additives in the normal refining procedures. Results of these investigations have been published in the publication "Ethanolamines and Other Amono- and Hydroxyl-Containing Compounds in the Refining of Rice Oil" by E. R. Cousins, R. Prachankadee and S. Bhodhiprasart, Journal of the American Oil Chemists' Society, Vol. 32, p. 561 (Nov. 1955).

This work has been concluded.

Statement by Marshall Miller of AMS

Marshall Miller of the Agricultural Marketing Service discussed the Marketing research functions of that Service. He pointed out that all marketing research activities of the Department of Agriculture are consolidated in a single division, namely, the Marketing Research Division of AMS. To carry out its broad and varied responsibilities, the Marketing Research Division has four Branches: the Market Development Branch, the Market Organization and Costs Branch, the Transportation and Facilities Branch, and the Biological Sciences Branch. The names of the Branches are closely identified with their functions.

It was pointed out that a number of rice marketing problems have been and are being studied in the fields of marketing costs, efficiency, transportation facilities and improvement and evaluation of product quality. He stated that his own Branch, the Market Development Branch, which is designed to assist through Marketing Research in expanding domestic consumption of agricultural products, presently could report no progress on market development research projects on rice. However, preliminary planning concerned with the possible development of such a program is underway. He went on to point out the nature

of possible market development research projects particularly relating to the needs of the rice industry. In a market development research program it would be necessary first to establish more specifically the basic characteristics of domestic rice markets through the determination of marketing patterns and other fundamental marketing information. A second important phase of research would include market testing, merchandising and consumer studies to ascertain the possibilities for expanding domestic markets. Research proposals on such lines of work will be submitted for consideration by the Rice Research and Marketing Advisory Committee.

The functions and purposes of the position established by AMS with headquarters at the SURB were discussed. Both AMS and ARS have as an important function, the providing of assistance to agricultural industries in expanding markets, this assistance to be achieved through marketing research and related activities, and through utilization research, respectively. In many cases, the ultimate objectives of research projects can be best achieved through coordinated and cooperative efforts; this position affords an excellent opportunity for the two Services to work closely together on those research activities where combined efforts will be beneficial.

## IV. LIST OF RECENT RICE PUBLICATIONS FROM SURB

X-ray and Photomicrographic Examination of Rice.
J. T. Hogan, R. A. Larkin and M. M. McMasters
Journal of Agricultural and Food Chemistry 2, 1235-9 (1954)

Simultaneous Recovery of Wax and Oil from Rice Bran by Filtration-Extraction.
J. Pominski, P. H. Eaves, H. L. E. Vix, and E. A. Gastrock
Journal of the American Oil Chemists' Society 31, 451-5 (1954)

Influence of Storage Without Aeration on the Microbial Populations of Rough Rice.
D. J. Teunisson
Cereal Chemistry 31, 462-74 (1954)

Tests from Freshly-Combined Rough Rice Stored in a Sealed Bin.
D. J. Teunisson
Journal of Applied Microbiology 2, 215-220 (1954)

Rice Research at the Southern Regional Research Laboratory.
R. W. Planck
Rice Annual 1954, 14-16, 18

Effect of Milling Conditions on Breakage of Rice Grains.
H. S. Autrey, W. W. Grigorieff, A. M. Altschul, and J. T. Hogan
Journal of Agricultural and Food Chemistry 3, 593-8 (1955)
World Rice, In Press

A Preliminary Cost Study of the Filtration-Extraction of Rice Wax.
J. Pominski, K. M. Decossas, P. H. Eaves, H. L. E. Vix, and E. F. Pollard
Journal of Industrial and Engineering Chemistry 47, 2109-11 (1955)

Ethanolamines and Other Amino- and Hydroxyl-Containing Compunds in the Refining of Rice Oil.
E. R. Cousins, R. Prachankadee, and S. Bhodhiprasart.
Journal of the American Oil Chemists' Society 32, 561-4 (1955)

Hygroscopic Equilibria of Rough Rice at Elevated Temperatures
J. T. Hogan and M. L. Karon
Journal of Agricultural and Food Chemistry 3, 855-60 (1955)

Rice Quality and Rice Oil Research at the Southern Regional Research Laboratory.
R. W. Planck
Rice Journal 58 (Annual Issue), 40-1, 98 (1955)

Effects of Heat-treatment on the Viability of Rice--A Report of Research and a Literature Survey.
V. H. McFarlane, J. T. Hogan and T. A. McLemore
U. S. Department of Agriculture, Technical Bulletin, In Press

## V. SUGGESTIONS FOR RESEARCH BY RICE MILLERS' ASSOCIATION

The afternoon session was begun by presentation of suggestions for research prepared by the Rice Millers' Association. These are as follows:

It is the conviction of The Rice Millers' Association that a well conceived and properly balanced program of research in the utilization and marketing field, can ultimately provide alleviation to many of the problems of surplus disposal that beset the industry today. We are also convinced that the facilities and the know-how for development of an effective rice

utilization research program exist at the Southern Regional Research Laboratory, and that the capability for developing and conducting effective research in marketing exists within the Agricultural Marketing Service. Because of these convictions, this meeting was arranged. Its purpose is to further acquaint researchers with needs and problems of the rice industry in the marketing and utilization research field, and to stimulate and urge development of a program of research that will meet the industry's needs.

Briefly stated, our recommendations in regard to both marketing and utilization research are: (1) That the U. S. Department of Agriculture vastly expand and intensify these research activities; (2) that a well-rounded and coordinated program of inquiry be quickly instituted, with initial emphasis on the areas where the need and promise seems greatest; and (3) that the program be well-balanced in respect to fundamental and applied phases.

In the marketing field there is need for study along many lines, and current work underway on certain marketing problems is proving valuable. At the present time, however, there is an absence of work in a very important field. We need current scientific information on the characteristics and potentials of the domestic market for rice, rice products, and rice by-products. For that reason we attach special immediate importance to market development study and urge that a program of market development research be quickly instituted on a scale that will enable assembling of information sorely needed by merchandisers of rice and rice products.

In the utilization research field, we feel that a desirable rice utilization research program should encompass several lines of separate but coordinated inquiry. For the benefit it might be to researchers, we have briefly outlined below the major lines of study which we feel should be incorporated into a program.

1. Studies of Composition.

Knowledge of the composition and properties of the different types of rice under different circumstances is fundamental to research in the utilization field; therefore, studies of composition are a necessary corollary, if not a pre-requisite, to a well-rounded utilization research program. We recommend that such studies be expanded and intensified to meet the needs. We urge, however, that studies of composition be considered as a means to an end, or steps to a goal, and not as the end or the goal of the research program, and that therefore such studies do not occupy an overshadowing or predominant position in the program. To prevent unnecessary duplication of work that has already been done, and reduce the amount of work that must be done on composition, it is suggested that a comprehensive library be assembled of published studies of rice composition in this country and in other countries of the world.

2. New Products and New Uses.

Development of new rice products and new uses for rice and rice by-products, offers challenging and broad possibilities for rice researchers. We urge that an intensive research program into new products and new uses be given high priority and considerable attention. To obtain ideas for this line of work, researchers might find it helpful to collect samples of rice products now distributed in the U. S., and in foreign countries to the extent practicable. In Japan and other countries of the Orient, many different rice products are made and consumed and perhaps some of them could be adapted to this country.

3. New and Improved Methods of Processing Milled Rice.

Any findings that will enhance rice's cooking quality, consumer appeal, ease and convenience of preparation, taste appeal, etc., would be of tremendous value. Some processes recommended for study are quick cooking, parboiling, freezing cooked rice, canning cooked rice, etc.

4. New or Improved Methods of Milling Rough Rice.

Milling of rough rice has been done by the same system of abrasion for many years. That time-honored system results in breakage of a high percentage of rice kernels, and since breakage reduces the value of rice kernels, substantial economic losses to the entire industry are suffered thereby. If a chemical means could be found for loosening the bran layers on the rice kernel so that less stringent abrasion is required, it would be of very significant value to the entire rice industry. It is urged that the possibilities in that direction be carefully explored.

5. Define Chemical and Physical Properties of Types of Rice Preferred by Major Markets.

In development of varieties of rice, the tendency has been to endeavor to breed into the varieties characteristics which make them desirable to growers. If plant breeders were apprised of the specific chemical and physical properties which are preferred by the major markets for U. S. rice, perhaps they could develop into rice varieties the attributes desired by consumers as well as those desired by growers. Therefore it is urged that researchers determine specific properties of rice which is preferred by major markets for U. S. rice, domestic and foreign, and work with plant breeders in breeding such qualities into rice varieties. In this line of inquiry attention might be focused on the principal markets, such as: Domestic users of conventionally milled rice; buyers of rice for quick

cooking, for canning, for breakfast cereals; and to important foreign markets such as Japan and Cuba. In Japan, for example, it is known that consumers prefer the native Japanese type rice to other rices. If utilization researchers would accurately determine the properties of native Japanese rice, and plant breeders could develop such properties into a variety that would have high field yields and be acceptable to farmers in all areas, it would substantially improve the competitive position of United States rice in bidding for business in the important Japanese market.

VI. PROGRAM OF RICE RESEARCH LISTED IN ORDER OF PRIORITY

Following the above presentation, there was a general discussion out of which came suggestions for eleven lines of research needed to improve the position of the rice industry. These were rated in an order of priority by the members of the rice industry. Included among these research proposals are some which are in the field of marketing research. They were included in the group to be rated with the understanding that information on their importance would be made available to the staff of the AMS. This is not an exhaustive list of marketing research proposals since the meeting was concerned primarily with utilization research.

The list of research proposals in order of priority of importance as rated by those in attendance is as follows:

1. Physical Properties and Chemical Composition of Rice. A strong and continuing investigation of the composition of rice and the physical and chemical properties of its constituents is recommended to provide the background information needed for progress in expanding the utilization of rice. Conduct investigations on the physical

characteristics of rice, such as permeability of the grain to moisture, differences in the hydrophilic character of the starch, the swelling of rice when cooked under controlled conditions, as related to the processing and eating quality of the rice and rice products. Study the gross and internal anatomy of the rice grain, by x-ray and photomicrographic techniques, to determine whether the structure of the grain is influenced by previous chemical or physical treatment. Determine the chemical composition and properties of rice as influenced by cultural, drying, storage and processing conditions. Factors, such as relative percentages of amylose and amylo pectin, occurrence and influence of carbohydrate-protein complexes, enzymatic breakdown of amylose and amylopectin, quality of protein, formation and influence of cross-linking on physical properties such as solubility and swelling, are to be studied in cooperation with rice processors to develop means of maintaining rice production at a high quality level, with plant breeders to develop superior rice varieties, and with nutritionists to provide products suitable to the needs and desires of both domestic and foreign consumers.

2. Market and Consumer Preference Studies. These studies would be directed at the possibilities for expanding the domestic market for rice. Such work would include the establishment of the basic characteristics of the domestic market, including marketing patterns and characteristics of consumers on as small an area basis as possible; individual market studies to ascertain specific factors associated with high and low rice consumption; consumer testing, market testing, and merchandising studies of new and improved rice products; and

analyses of effects of promotional campaigns on rice distribution in selected markets, among others. Study would also be directed to determining what the consumer wants and will buy; the availability of such rice products under present distribution systems; and what product improvements will be necessary to enhance consumer acceptance. This work will complement utilization research on physical and chemical composition of rice and production research on development of new and improved varieties.

Similar work should be undertaken for the principal foreign markets for American rice to define the specific properties of rice desired by each national group.

3. New Rice Products. Conduct research to develop new and improved products made from rice which would include more easily prepared quick-cooking rices, rice flour desserts, canned and frozen rice, and mixed food items, such as chicken and rice. The variety of such items should offer definite possibilities for increasing the utilization of rice by developing specific types of rice products desired by domestic and foreign consumers. Convenience of preparation, palatibility, and nutritive value of new products should be stressed. High starch content of milled rice suggests its use in baking, food preparations, noodles, and a variety of breakfast foods and snacks. Suggestions for new products may come from studying the variety of products from rice used in foreign countries. It is anticipated that AMS would cooperate in this work by carrying the results into marketing phases, particularly in determining consumer acceptance of new products and whether they offer possibilities for commercial adoption.

4. Industrial Uses of Rice and Rice Products. Conduct research on the use of broken kernels chiefly as a source of carbohydrate material in industrial processes. Although rice is sometimes used as a cereal adjunct in brewing, the use of malted rice is not a common practice. Investigation of the pretreatment necessary for adapting broken rice for brewing purposes should result in more widespread use of the grain for that purpose. Conduct research of the preparation of starch from the rice grain employing modern methods of processing such as used for corn and wheat. Rice starch, because of its small particle size, is ideally suited for starching fabrics and stiffening linens and curtains because it penetrates the interstices of the fabrics and is uniformly gelatinized by the hot iron without forming sticky patches or spotty areas. Older methods of production resulted in a final product too alkaline for many textile and chemical uses. Investigation of modern methods of processing rice for starch should indicate whether these undesirable properties can be eliminated. Research should be conducted on the production of sirups by acid hydrolysis of starch in broken rice kernels; adhesives, and starch derivatives for industrial purposes. AMS would cooperate in this work by determining the competitive position of rice as a raw material and the economic feasibility of the use of rice in various industrial products.

5. Stabilizing Brown, Undermilled, and Processed Rice. Conduct studies to improve the stability of brown, undermilled, and processed rice, with initial emphasis upon studies to alleviate the deteriorative changes occurring in the fat fractions, and to include development of

measures to overcome or prevent souring and microbial contamination. Overcoming the causes of deterioration would help broaden the utilization of rice products.

6. Long Term Storage of Rough and Milled Rice. Conduct investigations to determine the changes in composition of rough and milled rice after long term storage. Determine the internal microbial content of rough and the milled rice obtained from stored, air-dried rough rice that became sour when originally safe storage conditions became adverse, particularly if the relative humidity of the interseed atmosphere rose to 65% or higher, due to translocation of moisture in the rice pile. This investigation should include a study of "stackburn", which may be a related phenomenon. Investigate the effects of fumigants on the physical and chemical properties of the milled rice with particular attention to the influence of these chemicals on the color, taste, aroma, and stability of the rice and its processing characteristics.

7. New Approaches to Rice Milling. Conduct research on the development of new methods of milling rough rice and modifying the conventional abrasive type milling procedure with the aim of reducing milling losses through reduction of kernel breakage, improving milling efficiency, and increasing mill capacity. Data obtained on the physical and chemical properties of rice would be applicable in investigating the use of chemical reagents in loosening the bran layers on the rice kernel so that less stringent abrasion is required for proper milling. Investigate the application of recently developed sonic and flotation techniques as an aid in achieving satisfactory removal of bran from the rice kernel. Conduct further research on the effects of humidity

and temperature control during milling on the yield of head rice and the operating efficiency and capacity of the mill. Investigate further the influence of cooling and tempering rice during intermediate stages of processing in the mill. A method or combination of methods which would reduce milling losses could improve the competitive position of American rice in domestic and foreign markets.

8. By-Products of Rice. Conduct research on the extraction of oil and wax from rice bran and evaluate the physical and chemical of the products for use in commerce. Investigate fully the extraction and industrial properties of the naturally occurring emulsifiers present in rice bran oil. Conduct chick feeding studies on the use of ground rice hulls in feed mixes. Re-evaluate the economics of some of the previously proposed uses of rice hulls and straw in view of the increasing expansion and relocation of the petroleum and chemical industries. Economic difficulties of transportation are lessened and in many cases eliminated because of the construction of many industrial plants in the Gulf Coast area.

9. International Standards. Difficulty in exporting rice has arisen from a lack of understanding as to grade standards and requirements by different nations. Grades and standards of one nation do not have any meaning to others as far as use to be made of the rice. Indications are that specifications for grades be internationally agreed upon, similar to wheat, so that foreign purchasers know what they are getting when they purchase rice. It would help the export country to produce the type of rice needed by the importing countries. This

could be taken up and highly recommended to the F.A.O. of the United Nations as a means of eliminating an important drawback to more efficient utilization and marketing of world rice supplies.

10. Objective Standards. There is an interest in the development of objective standards for rice so that subjective evaluation as to rice grades would be eliminated insofar as possible. The aim is for grades of rough rice so determined by objective methods to indicate closely the quality and quantity of milled rice that could be obtained from a unit of rough rice. Work of this nature has been carried on by AMS and certain improvements have resulted.

11. Improved Drying of Rough Rice. Conduct research to develop improved procedures for drying rough rice, with particular attention to: (a) Determining the drying characteristics and subsequent product quality during holding (within practical limits) of rice under different conditions of temperatures, humidity, aeration, turning, and initial moisture content; (b) measuring the chemical and physical changes in rice that are initiated or accelerated during the drying operation; (c) establishing, in pilot-plant scale experiments, optimum conditions for each stage of a multi-pass drying operation for rice -- based upon specific conditions of temperature, humidity, and time for drying and tempering for each pass so as to minimize any deleterious effects; and (d) establishment of the relationship between the drying of rice and subsequent milling operations in order to make available drying techniques that will give the highest yield of optimum quality undermilled or polished white rice.

## VII. PLANS FOR PERMANENT COMMITTEE

It was decided that the group representing rice producers, millers and consumers be made into a permanent Rice Industry Research Committee. Mr. W. M. Reid was elected chairman and given authority to call the next meeting of the Committee whenever necessary.